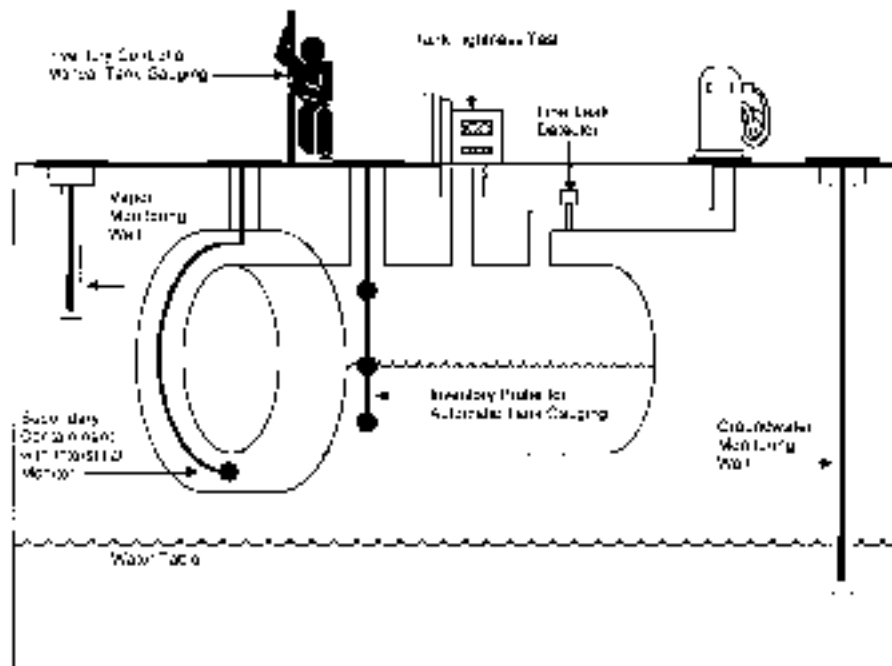


# MICHIGAN STRAIGHT TALK ON TANKS

## LEAK DETECTION METHODS FOR PETROLEUM UNDERGROUND STORAGE TANKS AND PIPING

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## Do You Have Questions About Leak Detection?

As an owner or operator of underground storage tanks (USTs) storing petroleum:

- ☑ Do you understand the basic leak detection requirements for USTs?
- ☑ Are you confused about choosing the most appropriate leak detection method for your UST?

These are important questions, because your UST and its underground piping must have leak detection **NOW**.

This booklet begins with an overview of the regulatory requirements for leak detection. Each of the following sections focuses on one leak detection method and the special requirements for piping.

In this booklet, you will find answers to many basic questions about how leak detection methods work and which methods are most appropriate for your UST system.

### Why is leak detection so important?

A tremendous amount of confirmed UST leaks had been reported nationwide. At sites without leak detection, leaks were discovered late, after contamination had spread, requiring difficult and costly cleanups.

By contrast, if you have effective leak detection, you can respond quickly to signs of leaks. You can minimize the extent of environmental damage and the threat to human health and safety. Early action on your part also protects you from the high costs that can result from cleaning up extensive leaks and responding to third-party liability claims.

If you need an overview of all the state requirements for USTs, please refer to the **Michigan Underground Storage Tank Rules (MUSTR)**. You can order a free copy of this booklet by calling the **Storage Tank Division** at **517-373-8168**, or send an e-mail to [DEQ-STD-TANKS@state.mi.us](mailto:DEQ-STD-TANKS@state.mi.us), or download the document from the website at <http://www.deq.state.mi.us/std/rules/mustr.html>.

## An Overview Of Leak Detection Requirements

**All new USTs** (those installed after December 22, 1988) must have leak detection when they are installed.

USTs installed before December 22, 1988 (called “existing USTs”) had compliance deadlines for leak detection phased in over five years. **By December 22, 1993, all “existing USTs” had to have leak detection.**

**MUSTR** has identified the following methods that owners and operators may use to meet the state and federal leak detection requirements:

- ☑ Secondary Containment With Interstitial Monitoring
- ☑ Automatic Tank Gauging Systems
- ☑ Vapor Monitoring
- ☑ Groundwater Monitoring
- ☑ Other Methods Approved By The State (e.g., some Statistical Inventory Reconciliation (SIR) methods)

The leak detection methods noted above are all **monthly monitoring methods** and eventually everyone must use at least one of them. However, as a **temporary** method (until 1998 or for 10 years after installing or upgrading an UST), you can combine tank tightness testing with inventory control (or with manual tank gauging if you have a small tank), as explained on page 4.

**Brief descriptions of leak detection methods appear on the next two pages. More complete descriptions appear in the following sections.**

Leak detection requirements for piping differ somewhat from those for tanks. Leak detection methods for piping include secondary containment with interstitial monitoring, vapor monitoring, groundwater monitoring, statistical inventory reconciliation, and tightness testing. Pressurized piping must also have an automatic line leak detector. See pages 22-25 for descriptions of the requirements for suction and pressurized piping.

☑ **Secondary Containment With Interstitial Monitoring** (see pages 6-7)

Secondary containment consists of having an outer wall around the UST or piping. Leaked product from the inner tank or piping is directed towards an “interstitial” monitor located between the inner tank or piping and the outer wall. Interstitial monitoring methods range from a simple dipstick to a continuous automated vapor or liquid sensor permanently installed in the system.

☑ **Automatic Tank Gauging Systems** (see pages 8-9)

A probe permanently installed in the tank is wired to a monitor to provide information on product level and temperature. These systems automatically calculate the changes in product volume that can indicate a leaking tank.

☑ **Vapor Monitoring** (see pages 10-11)

Vapor monitoring measures product “fumes” in the soil around the UST to check for a leak. This method requires installation of carefully placed monitoring wells. Vapor monitoring can be performed manually on a periodic basis or continuously using permanently installed equipment. This method cannot be used at sites where groundwater is less than 20 feet below the ground surface.

☑ **Groundwater Monitoring** (see pages 12-13)

Groundwater monitoring detects the presence of sheen resulting from liquid product floating on the groundwater. This method requires installation of monitoring wells at strategic locations in the ground near the tank and along the piping runs. To discover if leaked product has reached groundwater, these wells can be checked periodically by hand using a bailer or a transportable vapor monitor or continuously with permanently installed vapor monitoring equipment. This method cannot be used at sites where groundwater is less than three feet or more than 20 feet below the ground surface.

☑ **Other Methods Approved By The Regulatory Authority**

Regulatory authorities can approve any technology that meets a performance standard of detecting a leak of 0.2 gallons per hour with a probability of detection of at least 95 percent and a probability of false alarm of no more than five percent. Michigan has approved some ***Statistical Inventory Reconciliation (SIR)*** methods as meeting this criteria when used ***with Inventory Control*** conducted in accordance with **Section 280.43(a) of MUSTR**.

☑ **Statistical Inventory Reconciliation** (see pages 14-15)

In this method, a trained professional uses sophisticated computer software to conduct a statistical analysis of inventory, delivery, and dispensing data, which you must supply regularly.

☑ **Tank Tightness Testing With Inventory Control** (see pages 16-19)

This method ***combines*** periodic ***tank tightness testing*** with ***monthly inventory control***. Tightness tests are sophisticated tests performed by trained and certified professionals. You must also use monthly inventory control. Inventory control involves taking daily measurements of tank contents and recording deliveries and amount pumped. Note: this combined method can be used only during the first 10 years following new tank installation or upgrade of your existing UST. After that, you must use a monthly monitoring method.

☑ **Manual Tank Gauging** (see pages 20-21)

Manual tank gauging can be used only for tanks of 2,000 gallons or less capacity that are not used for motor vehicle fueling. This method requires keeping the tank undisturbed for at least 36 hours each week, during which the contents of the tank are measured twice at the beginning and twice at the end of the test period. At the end of the month, you average the weekly tests and compare the results to the standards shown on page 23 to see if your tank may be leaking. This method can be used by itself only for tanks up to 550 gallons. Tanks between 551 and 2,000 gallons can use this method only in combination with periodic tank tightness testing. This combined method, however, can be used only during the first 10 years after tank installation or upgrade.

**Look For The “Proof” Of A Third-Party Evaluation**

An evaluation performed by a third party (someone who is independent of the manufacturer or vendor of the leak detection system) shows that a leak detection system can work as designed. The evaluation follows required evaluation procedures, and often takes place at a testing facility. EPA and third parties have developed evaluation procedures for many leak detection systems.

Although an evaluation and its resulting documentation are technical, you should be familiar with the evaluation's "results" form and, when provided, its "description" forms. You should obtain these forms from the leak detection vendor and keep them on file. They contain a signed certification that the system performed as described, as well as documenting any limitations of the system. This information is important to your compliance with the UST requirements. For example, if a tank tightness test was evaluated and certified only for tests taking two hours or more, then your UST must be tested for at least two hours or it would fail to meet the leak detection requirements.

### **Required "Probabilities" For Some Leak Detection**

The regulations require not only that leak detection methods be able to detect certain leak rates, but that they also give the correct answer consistently. In general, methods must detect the specified leak rate with a probability of detection of at least 95 percent and a probability of false alarm of no more than five percent. Simply stated, this means that, of 100 tests of USTs leaking at the specified rate, at least 95 of them must be correctly detected. It also means that, of 100 tests of non-leaking USTs, no more than five can be incorrectly called leaking. This is what is meant by the "probabilities" noted in this booklet.

### **Which leak detection method is best for you?**

There is no one leak detection system that is best for all sites, nor is there a particular type of leak detection that is consistently the least expensive.

Each leak detection method has unique characteristics. Identifying the best leak detection choice for your UST depends on a number of factors including cost (both initial installation cost and long-term operation and maintenance cost), facility configuration (such as complexity of piping runs and manifolded tanks), groundwater depth, soil type, seasonal rainfall and temperature ranges, availability of experienced installers, and other variables.

You should look around extensively for experienced professional vendors and installers of leak detection. Ask questions that help you find the most reliable, cost-effective leak detection for your type of facility. Some possible information sources are: references from fellow UST owners, oil marketers, equipment suppliers, trade journals, trade associations (especially those for petroleum marketers and UST owners), and state regulatory authority.

For additional information about UST requirements, contact the **Storage Tank Division at 517-373-8168**.

## **Secondary Containment With Interstitial Monitoring**

### **Will you be in compliance?**

When installed and operated according to the manufacturer's specifications, secondary containment with interstitial monitoring meets the state and federal leak detection requirements for new and existing USTs. Monitoring this interstitial space at least once each month fulfills the requirements for the life of the tank. Secondary containment with interstitial monitoring can also be used to detect leaks from piping (see the section on leak detection for piping starting on page 22).

### **How does the leak detection method work?**

#### **Secondary containment**

- ☑ Secondary containment for tanks means a double wall tank where the outer wall (the secondary wall) surrounds the inner wall (the primary wall). The secondary wall must at least cover 330 degrees of the primary wall while providing an interstitial space between the two walls for interstitial monitoring.

#### **Or**

- ☑ Secondary containment for tanks means an integral secondary containment system, a “jacketed” tank, consisting of a UL 58 steel primary tank with an approved non-metallic secondary containment tank surrounding the primary tank completely (360 degrees). The integral secondary containment system must also provide liquid communication in the interstitial space for effective interstitial monitoring.

#### **Interstitial monitors**

- ☑ Monitors are used to check the area between the primary and the secondary walls for leaks from either wall and alert the operator if a leak is suspected.
- ☑ Some monitors indicate the physical presence of the leaked product, either liquid or gaseous. Other monitors check for a change in condition that indicates a hole in the tank, such as a loss of vacuum or a change in the level of a monitoring liquid between the walls of a double-walled tank.
- ☑ Monitors can be as simple as a dipstick used to see if liquid product has leaked and pooled. Monitors can also be sophisticated automated systems that continuously check for leaks.

**What are the regulatory requirements?**

- ☑ The interstitial monitor must be checked at least once every 30 days.
- ☑ A double-walled system must be able to detect a release through any point on the inner wall.

**Will it work at your site?**

- ☑ In areas with high groundwater or a lot of rainfall, it may be necessary to select a secondary containment system where the access to the interstitial space is properly sealed to prevent moisture from interfering with the monitor.

**Anything else you should consider?**

- ☑ This method works effectively only if the interstitial riser, cap, and monitor are installed correctly. Therefore, trained and experienced installers are necessary.

## **Automatic Tank Gauging Systems**

### **Will you be in compliance?**

When installed and operated according to the manufacturer's specifications, automatic tank gauging systems (ATGS) meet the state and federal leak detection requirements for new and existing USTs. A test performed each month and inventory control fulfills the requirements for the life of the tank. (For additional requirements for piping, see the section on leak detection for piping starting on page 22.)

### **How does the leak detection method work?**

- ☑ The product level and temperature in a tank are measured continuously and automatically analyzed and recorded by a computer.
- ☑ In the "inventory mode," the ATGS replaces the use of the gauge stick to measure product level and perform inventory control. This mode records the activities of an in-service tank, including deliveries.
- ☑ In the "test mode," the tank is taken out of service and the product level and temperature are measured for at least an hour.

### **What are the regulatory requirements?**

- ☑ The ATGS must be able to detect a leak no larger than 0.2 gallons per hour with certain probabilities of detection and of false alarm. Some ATGS can also detect a leak of 0.1 gallons per hour with the required probabilities.

### **Will it work at your site?**

- ☑ ATGS have been used primarily on tanks containing gasoline or diesel. If considering using an ATGS for larger tanks or products other than gasoline or diesel, discuss its applicability with the manufacturer's representative.
- ☑ Water around a tank may hide a leak by temporarily preventing the product from leaving the tank. To detect a leak in this situation, the ATGS should be capable of detecting water in the bottom of the tank.

### **Anything else you should consider?**

- ☑ The ATGS probe is permanently installed through an opening (not the fill pipe) on the top of the tank. Each tank at a site must be equipped with a separate probe.
- ☑ The ATGS probe is connected to a monitor that displays ongoing product level information and the results of the monthly test. Printers can be connected to the monitor to record this information.
- ☑ ATGS are often equipped with alarms for high and low product level, high water level, and theft.
- ☑ ATGS can be linked with computers at other locations, from which the system can be programmed and read.
- ☑ No product should be delivered to the tank or withdrawn from it for a specified time period before the monthly test or during the test. Inquire about the ATGS required down time.
- ☑ An ATGS can be programmed to perform a test more often than once per month (a recommended practice).
- ☑ Remember you are still required to conduct inventory control using the ATGS and totalizer or card reader and complete the monthly inventory reconciliation process.

## Vapor Monitoring

### Will you be in compliance?

When installed and operated according to the manufacturer's instructions, vapor monitoring meets the state and federal leak detection requirements for new and existing USTs. Operation of a vapor monitoring system at least once each month fulfills the requirements for the life of the tank. Vapor monitoring can also be installed to detect leaks from piping (see the section on leak detection for piping starting on page 22).

### How does the leak detection method work?

- ☑ Vapor monitoring senses or measures "fumes" from leaked product in the soil around the tank to determine if the tank is leaking.
- ☑ Fully automated vapor monitoring systems have, permanently installed, equipment to continuously or periodically gather and analyze vapor samples and respond to a release with a visual or audible alarm.
- ☑ Manually operated vapor monitoring systems range from equipment that immediately analyzes a gathered vapor sample to devices that gather a sample that must be sent to a laboratory for analysis. Monitoring results from manual systems are generally less accurate than those from automated systems. Manual systems must be used at least once a month to monitor a site.
- ☑ All vapor monitoring devices should be periodically calibrated according to the manufacturer's instructions to ensure that they are properly responding.
- ☑ Before installation, a site evaluation is necessary to determine the soil type, groundwater depth, and the general geology of the site. This evaluation can only be done by a trained professional, and requires state review.
- ☑ The number of wells and their placement is very important. Only an experienced contractor can properly design and construct an effective monitoring well system. Vapor monitoring requires the installation of monitoring wells within the tank backfill; and state review of the plan for the number and location of wells for each facility is required.

### **What are the regulatory requirements?**

- ☑ The UST backfill must be sand, gravel, or another material that will allow the vapors to easily move to the monitor.
- ☑ The backfill should be clean enough that previous contamination does not interfere with the detection of a current leak.
- ☑ The substance stored in the UST must vaporize easily or a tracer must be added periodically so that the vapor monitor can detect a release.
- ☑ High ground water, excessive rain, or other sources of moisture must not interfere with the operation of vapor monitoring for more than 30 consecutive days.
- ☑ Monitoring wells must be secured, liquid tight, and clearly marked.
- ☑ Prior approval by the STD is required for utilization of this method.

### **Will it work at your site?**

- ☑ Before installing a vapor monitoring system, a site evaluation must be done to determine whether vapor monitoring is appropriate at the site. A site evaluation usually includes at least a determination of the groundwater level, background contamination, stored product type, and soil type. This evaluation can only be done by a trained professional.

## **Groundwater Monitoring**

### **Will you be in compliance?**

When installed and operated according to the manufacturer's instructions, a groundwater monitoring system meets the state and federal leak detection requirements for new and existing USTs. Operation of a groundwater monitoring system at least once each month fulfills the requirements for the life of a tank. Groundwater monitoring can also be used to detect leaks in piping (see the section on leak detection for piping starting on page 22).

### **How does the leak detection method work?**

- ☑ Groundwater monitoring involves the use of permanent monitoring wells placed close the UST. The wells are checked at least monthly for the presence of product that has leaked from the UST and is floating on the groundwater surface.
- ☑ The two main components of a groundwater monitoring system are the monitoring well (typically a well is 2-4 inches in diameter) and the monitoring device.
- ☑ Detection devices may be permanently installed in the well for automatic, continuous measurements for leaked product (sensing the vapor in the monitoring well and triggering an alarm).
- ☑ Detection devices are also available in manual form. Manual devices range from a bailer (used to collect a liquid sample for visual inspection) to a device that can be inserted into the well to electronically indicate the presence of leaked product. Manual devices must be operated at least once a month.
- ☑ Before installation, a site evaluation is necessary to determine the soil type, groundwater depth and flow direction, and the general geology of the site. This evaluation can only be done by a trained professional, and requires state review.
- ☑ The number of wells and their placement is very important. Only an experienced contractor can properly design and construct an effective monitoring well system. A minimum of three wells will be needed for a single tank excavation, and state review of the plan for the number and location of monitoring wells for each facility is required.

### **What are the regulatory requirements?**

- ☑ Groundwater monitoring can only be used if the stored substance does not easily mix with water and floats on top of water.
- ☑ If groundwater monitoring is to be the sole method of leak detection, the groundwater must not be more than 20 feet nor less than three feet below the surface, and the soil between the well and the UST must be sand, gravel, or other coarse material.
- ☑ Monitoring wells must be properly designed and sealed to keep them from becoming contaminated from surface runoff and overburden infiltration sources. The wells must also be clearly marked and secured.
- ☑ Wells should be placed in the UST backfill so that they can detect a leak as quickly as possible.
- ☑ Product detection devices must be able to detect any amount of leaked product in liquid or vapor phase on top of the groundwater.
- ☑ Prior approval by the STD is required for utilization of this method.

### **Will it work at your site?**

- ☑ In general, groundwater monitoring works best at UST sites where:
  - Monitoring wells are installed in the tank backfill; and
  - There are no previous releases of product that would falsely indicate a current release.
- ☑ A professionally conducted site evaluation is critical for determining these site-specific conditions.

## **Statistical Inventory Reconciliation**

### **Will you be in compliance?**

State approved statistical inventory reconciliation (SIR) methods, when performed according to the vendor's specification, meets state, and federal leak detection requirements for new and existing USTs. SIR can, if it has the capability of detecting smaller leaks, meet the state, and federal requirements for line leak detection as well. (For additional requirements for piping, see the section on leak detection for piping starting on page 22.)

### **How does the leak detection method work?**

- ☑ SIR analyzes inventory, delivery, and dispensing data collected over a period of time to determine whether or not a tank system is leaking.
- ☑ Each operating day, the product level is measured using a gauge stick or other tank level monitor. You also keep complete records of all withdrawals from the UST and all deliveries to the UST. After data have been collected for the period of time required by the SIR vendor, (usually less than one month), you provide the data to the SIR vendor.
- ☑ The SIR vendor uses sophisticated computer software to conduct a statistical analysis of the data to determine whether or not your UST may be leaking. The SIR vendor provides you with a test report of the analysis.

### **What are the regulatory requirements?**

- ☑ To be allowable as monthly monitoring, a SIR method must be preapproved as meeting the state requirements. Data must be submitted at least monthly.
- ☑ The individual SIR method must have been evaluated with a test procedure to certify that it can detect leaks at the required level and with the appropriate probabilities of detection and of false alarm.
- ☑ If the test report is not conclusive, you must take the steps necessary to find out conclusively whether your tank is leaking.
- ☑ You must keep on file both the test reports and the documentation that the SIR method used is approved and certified as valid for your UST system.

### **Will it work at your site?**

- ☑ Generally, few product or site restrictions apply to the use of SIR.
- ☑ SIR has been used on tanks of various capacities. If you are considering using a SIR method for larger tanks, discuss its applicability with the vendor.
- ☑ Water around a tank may hide a hole in the tank or distort the data to be analyzed by temporarily preventing a leak. To detect a leak in this situation, you must check for water at least once a month.

### **Anything else you should consider?**

- ☑ Data, including product level measurements, dispensing data, and delivery data, should all be carefully collected according to state requirements and the SIR vendor's specifications. Poor data collection produces inconclusive results and noncompliance.
- ☑ The SIR vendor will generally provide forms for recording data, a calibrated chart converting liquid level to volume, and detailed instructions on conducting measurements.
- ☑ SIR should not be confused with other release detection methods that also rely on periodic reconciliation of inventory, withdrawal, and delivery data. Unlike manual tank gauging or inventory control, SIR uses a sophisticated statistical analysis of data to detect releases. This analysis can only be done by competent, trained practitioners.

For additional information on SIR, you can order a free copy of **Introduction To Statistical Inventory Reconciliation For Underground Storage Tanks In Michigan** by calling the **Storage Tank Division** at **517-373-8168**.

## **Tank Tightness Testing With Inventory Control**

### **Will you be in compliance?**

When performed according to the manufacturer's specification, periodic tank tightness testing combined with monthly inventory control can temporarily (as described below) meet the state and federal leak detection requirements for new and existing USTs.

These two leak detection methods must be used together, because neither method alone meets the state and federal requirements for leak detection for tanks. Tightness testing is also an option for underground piping, as described in the section on leak detection for piping starting on page 22.

Because they must be used together, both tank tightness testing and inventory controls are discussed in this section. Tank tightness testing is discussed first, followed by inventory control.

If your UST system has been installed or upgraded for more than 10 years this method is no longer allowed.

### **Tank Tightness Testing**

#### **How does the leak detection method work?**

Tightness tests include a wide variety of methods. Other terms used for these methods include "precision," "volumetric," and "nonvolumetric" testing.

- ☑ Many tightness test methods are "volumetric" methods in which the change in product level in a tank over several hours is measured very precisely (in milliliters or thousandths of an inch).
- ☑ Other methods use acoustics or tracer chemicals to determine the presence of a hole in the tank. With such methods, all of the factors in the following bullets may not apply.
- ☑ For most methods, changes in product temperature also must be measured very precisely (thousandths of a degree) at the same time as level measurements, because temperature changes cause volume changes that interfere with finding a leak.
- ☑ For most methods, a net decrease in product volume (subtracting out volume changes caused by temperature) over the time of the test indicates a leak.
- ☑ The testing equipment is temporarily installed in the tank, usually through the fill pipe.

- ☑ The tank must be taken out of service for the test, generally for several hours, depending on the method.
- ☑ Many test methods require that the product in the tank be a certain level before testing, which often requires adding product from another tank on-site or purchasing additional product.
- ☑ Some tightness test methods require all of the measurements and calculations to be made by hand by the tester. Other tightness test methods are highly automated. After the tester sets up the equipment, a computer controls the measurements and analysis.
- ☑ A few methods measure properties of the product that are independent of temperature, such as the mass of the product, and so do not need to measure product temperature.

### **What are the regulatory requirements?**

- ☑ The tightness test method must be able to detect a leak at least as small as 0.1 gallon per hour with certain probabilities of detection and of false alarm.
- ☑ Tightness tests must be performed periodically. New tanks must be tightness tested every five years for 10 years following installation. Upgraded existing tanks must be tightness tested every five years for 10 years following upgrade. ("Upgraded" tanks have overfill and corrosion protection.)
- ☑ After the applicable time period noted above, you must have a monitoring method that can be performed at least once per month. See the other sections of this booklet for allowable monthly monitoring options.

### **Will it work at your site?**

- ☑ Tank tightness testing has been used and certified on tanks of different capacities containing gasoline and diesel. If you are considering using tightness testing for larger tanks or products other than gasoline or diesel, discuss the method's applicability with the manufacturer's representative.

### **Anything else you should consider?**

- ☑ For most methods, the test is performed by a testing company. You just observe the test.
- ☑ Manifolded tanks generally should be disconnected and tested separately.
- ☑ Depending on the method, up to four tanks can be tested at one time. Generally, an automated system is necessary to test three or four tanks at a time.
- ☑ Procedure and personnel, not equipment, are usually the most important factors in a successful tightness test. Therefore, well-trained and experienced testers are very important. The tester should be trained and certified by the manufacturer or vendor of the testing method and must be able to present a valid certificate before conducting the test.

### **Inventory Control**

#### **How does the leak detection method work?**

Inventory control requires daily measurements of tank contents and math calculations that let you compare your “stick” inventory (what you’ve measured) to your “book” inventory (what your recordkeeping indicates you should have). Some people call this process “inventory reconciliation.” If the difference between your “stick” and “book” inventory is too large, your tank may be leaking.

- ☑ UST inventories are determined daily by using a gauge stick. The level on the gauge stick is converted to a volume of product in the tank using a calibration chart, furnished by the UST manufacturer, and recorded on a form.
- ☑ The amounts of product delivered to and withdrawn from the UST each day are also recorded. At least once each month, the gauge stick data and the sales and delivery data are reconciled and the month’s overage or shortage is determined. If the overage or shortage is greater than or equal to 1.0 percent of the tank’s flow-through volume plus 130 gallons of product, the UST may be leaking.

### **What are the regulatory requirements?**

- ☑ Inventory control must be used in conjunction with periodic tank tightness tests.
- ☑ The gauge stick should be long enough to reach the bottom of the tank and marked so that the product level can be determined to the nearest one-eighth of an inch.
- ☑ A monthly measurement must be taken to identify any water at the bottom of the tank.
- ☑ Deliveries must be made through a drop tube that extends to within six inches of the tank bottom.
- ☑ Product dispensers must be calibrated to within six cubic inches for every five gallons of product withdrawn.

### **Will it work at your site?**

If your tank is not level, inventory control may need to be modified. You will need to get a corrected tank chart.

### **Anything else you should consider?**

- ☑ Inventory control is a practical, commonly used management tool that does not require closing down the tank operation for long periods.
- ☑ You can perform inventory control yourself.
- ☑ The accuracy of tank gauging can be greatly increased by spreading product-finding paste on the gauge stick before taking measurements (or by using in-tank product level monitoring devices).

## Manual Tank Gauging

### Will you be in compliance?

NOTE: **Manual tank gauging cannot be chosen when tanks are used for motor vehicle fueling.** This method is used for tanks that have 550 gallons or less as a stand alone method of release detection, but tanks from 551 to 2,000 gallons can use manual tank gauging when it is combined with tank tightness testing. **Manual tank gauging cannot be used for tanks over 2,000 gallons.** When performed according to recommended practices, manual tank gauging meets the state and federal leak detection requirements for USTs with a capacity of 550 gallons or less for the life of the tank. (For additional requirements for piping, see the section on leak detection for piping starting on page 22.)

If your UST has been installed or upgraded for more than 10 years this method is no longer allowed for tanks over 551 to 2,000 gallons.

### How does the leak detection method work?

- ☑ Four measurements of the tank's contents must be taken weekly, two at the beginning and two at the end of **at least a 36-hour period** during which nothing is added to or removed from the tank. See the table on the next page.
- ☑ The average of the two consecutive ending measurements are subtracted from the average of the two beginning measurements to indicate the change in product volume.
- ☑ Every week, the calculated change in tank volume is compared to the standards shown in the table on the next page. If the calculated change exceeds the weekly standard, the UST may be leaking. Also, monthly averages of the four weekly test results must be compared to the monthly standard in the same way. See the table on the next page.

### What are the regulatory requirements?

- ☑ Liquid level measurements must be taken with a gauge stick that is marked to measure the liquid to the nearest one-eighth of an inch.
- ☑ Manual tank gauging may be used as the sole method of leak detection for tanks with a capacity of 550 gallons or less for the life of the tank. Tanks between 551 and 2,000 gallons may use a combination of manual tank gauging and periodic tank tightness testing for the life of the tank (see table for testing standards).

**Table of Test Standards for Manual Tank Gauging**

<b>Tank Size</b>	<b>Minimum Duration of Test</b>	<b>Weekly Standard (1 test)</b>	<b>Monthly Standard (4-test average)</b>
up to 550 gallons	36 hours	10 gallons	5 gallons
551 - 1,000 gallons (also requires periodic tank tightness testing)	36 hours	13 gallons	7 gallons
1,001 - 2,000 gallons (also requires periodic tank tightness testing)	36 hours	26 gallons	13 gallons

- ☑ For tanks with a capacity of 551 - 2,000 gallons, manual tank gauging must be combined with periodic tightness testing. New tanks must be tightness tested every five years for 10 years following installation. Upgraded tanks must be tightness tested every five years for 10 years following upgrade. ("Upgraded" tanks have overfill and corrosion protection.) Existing tanks that have not been upgraded must be tightness tested every year until 1998. See the earlier section on tank tightness testing for details on this method.
- ☑ Unless the tank is 550 gallons or less, this combined method will meet the state and federal requirements only **temporarily** (as explained above). You must eventually have another monitoring method that can be performed at least once a month. See the other sections of this booklet for allowable monthly monitoring options.
- ☑ Tanks greater than 2,000 gallons in capacity or tanks used for motor vehicle fueling may not use this method of leak detection to meet these regulatory requirements.

**Will it work at your site?**

- ☑ Manual tank gauging is inexpensive and can be an effective leak detection method when used as described above with tanks of the appropriate size.

**Anything else you should consider?**

- ☑ You can perform manual tank gauging yourself. Correct gauging, recording, and interpretation are the most important factors for successful tank gauging. The accuracy of tank gauging can be greatly increased by spreading product-finding paste on the gauge stick before taking measurements.

## **Leak Detection For Underground Piping**

### **Will you be in compliance?**

When installed and operated according to the manufacturer's specifications, the leak detection methods discussed here meet the state and federal regulatory requirements for the life of new and existing underground piping systems. Your UST may have suction or pressurized piping, which are discussed below.

### **What are the regulatory requirements for suction piping?**

- ☒ No leak detection is required if the suction piping has (1) enough slope so that the product in the pipe can drain back into the tank when suction is released and (2) has only one check valve, which is as close as possible beneath the pump in the dispensing unit.
- ☒ If a suction line does not meet all of the design criteria noted above, one of the following leak detection methods must be used:
  - A line tightness test at least every three years; or
  - Monthly interstitial monitoring; or
  - Monthly vapor monitoring; or
  - Monthly groundwater monitoring; or
  - Monthly statistical inventory reconciliation.

The line tightness test must be able to detect a leak at least as small as 0.1 gallons per hour at one and one-half the operating pressure with certain probabilities of detection and of false alarm.

Interstitial monitoring, vapor monitoring, groundwater monitoring, and statistical inventory reconciliation have the same regulatory requirements for piping as they do for tanks. See the earlier sections of this booklet on those methods.

## **What are the regulatory requirements for pressurized piping?**

Pressurized piping must have one leak detection method from each set below:

### **An Automatic Line Leak Detector:**

- Automatic flow restrictor; or
- Automatic flow shutoff; or
- Continuous alarm system.

### **And One Other Method:**

- Monthly interstitial monitoring; or
  - Monthly vapor monitoring; or
  - Monthly groundwater monitoring; or
  - Monthly statistical inventory reconciliation; or
  - Annual tightness test.
- 
- ☑ The automatic line leak detector (LLD) must be designed to detect a leak at least as small as three gallons per hour at a line pressure of 10 pounds per square inch within one hour by shutting off the product flow, restricting the product flow, or triggering an audible or visual alarm.
  - ☑ The line tightness test must be able to detect a leak at least as small as 0.1 gallons per hour when the line pressure is 1.5 times its normal operating pressure. The test must be conducted each year. If the test is performed at pressures lower than 1.5 times operating pressure, the leak rate to be detected must be correspondingly lower.
  - ☑ Automatic LLDs and line tightness tests must also be able to meet the state and federal regulatory requirements regarding probabilities of detection and false alarm.
  - ☑ Interstitial monitoring, vapor monitoring, groundwater monitoring, and statistical inventory reconciliation have the same regulatory requirements for piping as they do for tanks. See the earlier sections of this booklet on those methods.

## **How do the leak detection methods work?**

### **Automatic line leak detectors (LLDs)**

- ☑ Flow restrictors and flow shutoffs can monitor the pressure within the line in a variety of ways: whether the pressure decreases over time; how long it takes for a line to reach operating pressure; and combinations of increases and decreases in pressure.
- ☑ If a suspected leak is detected, a flow restrictor keeps the product flow through the line well below the usual flow rate. If a suspected leak is detected, a flow shutoff completely cuts off the flow in the line or shuts down the pump.
- ☑ A continuous alarm system constantly monitors line conditions and immediately triggers an audible or visual alarm if a leak is suspected. Automated internal, vapor, or interstitial line monitoring systems can also be set up to operate continuously and sound an alarm, flash a signal on the console, or even ring a telephone in a manager's office when a leak is suspected.
- ☑ Both automatic flow restrictors and shutoffs are permanently installed directly into the pipe or the pump housing.
- ☑ Vapor and interstitial monitoring systems can be combined with automatic shutoff systems so that whenever the monitor detects a suspected release the piping system is shut down. This would qualify as a continuous alarm system. Such a setup would meet the monthly monitoring requirement as well as the LLD requirement.

### **Line tightness testing**

- ☑ Tracer methods do not measure pressure or flow rates of the product. Instead they use a tracer chemical to determine if there is a hole in the line. With tracer methods, all of the factors below may not apply.
- ☑ The line is taken out of service and pressurized, usually above the normal operating pressure. A drop in pressure over time, usually an hour or more, suggests a possible leak.
- ☑ Suction lines are not pressurized very much during a tightness test (about seven to 15 pounds per square inch).
- ☑ Most line tightness tests are performed by a testing company. You just observe the results.
- ☑ Some tank tightness test methods can be performed to include a tightness test of the connected piping.

- ☑ For most line tightness tests, no permanent equipment is installed.
- ☑ In the event of trapped vapor pockets, it may not be possible to conduct a valid line tightness test. There is no way to tell definitely before the test begins if this will be a problem, but long complicated piping runs with many risers and dead ends are more likely to have vapor pockets.
- ☑ Some permanently installed electronic systems can meet the requirements of a line tightness test.

### **Secondary containment with interstitial monitoring**

- ☑ Double-walled piping can be used.
- ☑ A monitor is placed between the primary and secondary piping to sense a leak if it occurs. Monitors range from a simple inspection of the sump to see if a liquid is present, to continuous automated systems, such as those that monitor for the presence of liquid product or vapors.
- ☑ Proper installation of secondary containment is the most important and the most difficult aspect of this leak detection method. Trained and experienced installers are necessary.
- ☑ See the section on secondary containment for additional information. Secondary containment for piping is similar to that for tanks.

### **Vapor or groundwater monitoring**

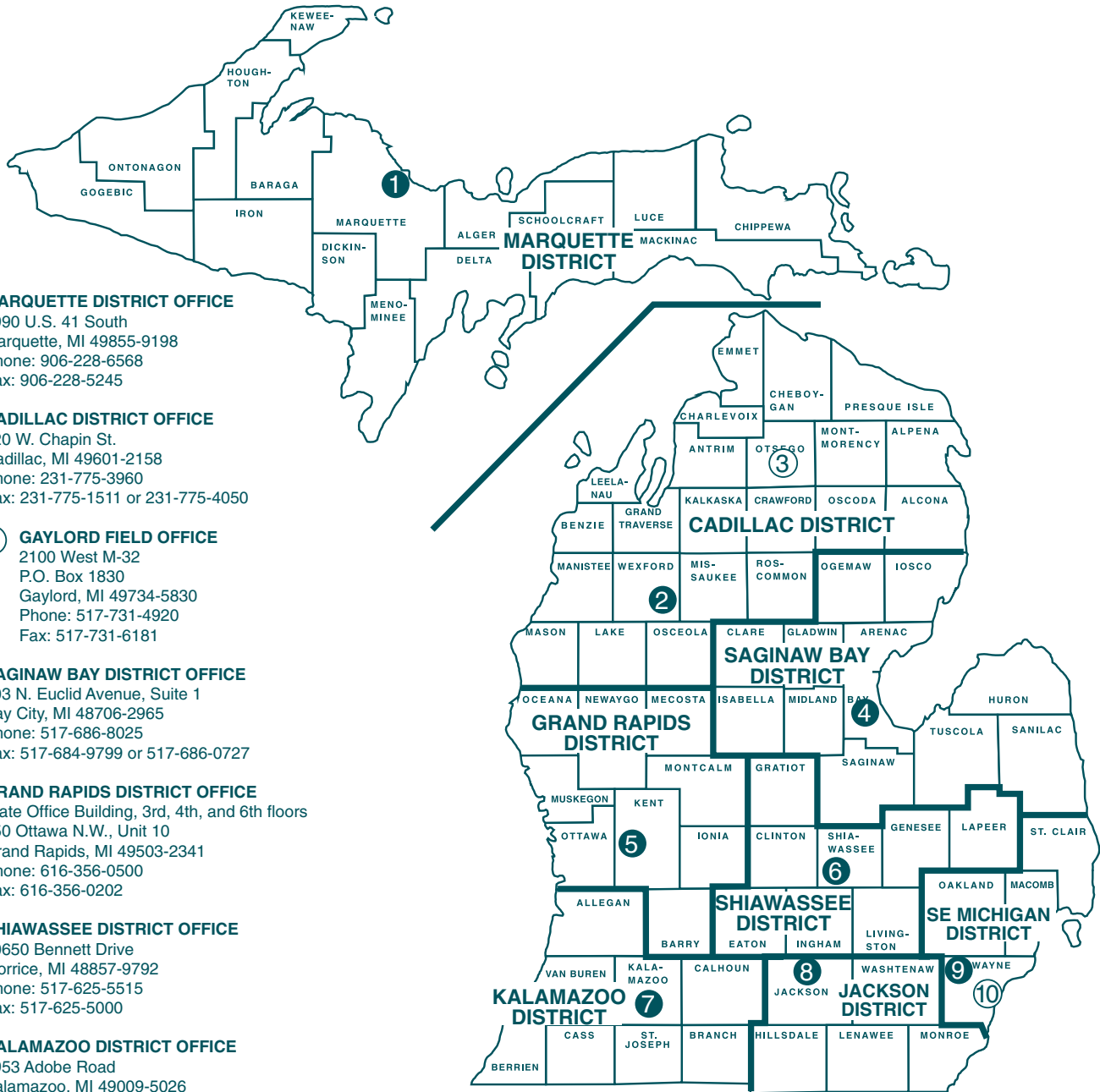
- ☑ Vapor monitoring detects product that leaks into the soil and evaporates.
- ☑ Groundwater monitoring checks for leaked product floating on the groundwater near the piping.
- ☑ A site evaluation must be used to determine monitoring well placement and spacing.
- ☑ UST systems using vapor or groundwater monitoring for the tanks are well suited to use the same monitoring method for the piping.
- ☑ See the earlier sections on vapor and groundwater monitoring. Use of these methods with piping is similar to that for tanks.



## MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

### District and Office Boundaries and Locations

John Engler, Governor • Russell J. Harding, Director



#### 1 MARQUETTE DISTRICT OFFICE

1990 U.S. 41 South  
Marquette, MI 49855-9198  
Phone: 906-228-6568  
Fax: 906-228-5245

#### 2 CADILLAC DISTRICT OFFICE

120 W. Chapin St.  
Cadillac, MI 49601-2158  
Phone: 231-775-3960  
Fax: 231-775-1511 or 231-775-4050

#### 3 GAYLORD FIELD OFFICE

2100 West M-32  
P.O. Box 1830  
Gaylord, MI 49734-5830  
Phone: 517-731-4920  
Fax: 517-731-6181

#### 4 SAGINAW BAY DISTRICT OFFICE

503 N. Euclid Avenue, Suite 1  
Bay City, MI 48706-2965  
Phone: 517-686-8025  
Fax: 517-684-9799 or 517-686-0727

#### 5 GRAND RAPIDS DISTRICT OFFICE

State Office Building, 3rd, 4th, and 6th floors  
350 Ottawa N.W., Unit 10  
Grand Rapids, MI 49503-2341  
Phone: 616-356-0500  
Fax: 616-356-0202

#### 6 SHIAWASSEE DISTRICT OFFICE

10650 Bennett Drive  
Morrice, MI 48857-9792  
Phone: 517-625-5515  
Fax: 517-625-5000

#### 7 KALAMAZOO DISTRICT OFFICE

7953 Adobe Road  
Kalamazoo, MI 49009-5026  
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Fax: 616-567-9440

#### 8 JACKSON DISTRICT OFFICE

301 E. Louis B. Glick Highway  
Jackson, MI 49201-1556  
Phone: 517-780-7690  
Fax: 517-780-7855

#### 9 SOUTHEAST MICHIGAN DISTRICT OFFICE

38980 Seven Mile Road  
Livonia, MI 48152-1006  
Phone: 734-953-8905  
Fax: 734-953-0243 or 734-953-1544

#### 10 DETROIT FIELD OFFICE

300 River Place, Suite 3600  
Detroit, MI 48207  
Phone: 313-392-6480  
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9 denotes district office

10 denotes field office

#### STORAGE TANK DIVISION MAIN OFFICE

Town Center  
333 S. Capitol, 2nd Floor  
P.O. Box 30157  
Lansing, MI 48909-7657  
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Email: [deq-std-tanks@state.mi.us](mailto:deq-std-tanks@state.mi.us)

Report Underground Storage Tank Releases:  
800-642-4878

#### STD Web Site

[www.deq.state.mi.us/std](http://www.deq.state.mi.us/std)